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Status and Prospects for Development Work on Resists for Microelectronics

927K0053A Moscow *ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII* in Russian Vol 36 No 3, May-Jun 91 (manuscript received 30 Oct 90) pp 179-188

[Article by D. B. Askerov, NIOPIK Moscow Scientific Production Association]

UDC 773.93;771.531

[Abstract] The principal directions in producing resist materials with a submicron resolution for use in microelectronics are discussed. Table 1 gives the characteristics of Soviet-produced positive photoresists. Particular attention is given to multilayer resists and resists for the short-wave UV region. The characteristics of Soviet produced materials for multilayer lithography and use in the short-wave UV region are given in Tables 2 and 3 respectively. According to predictions, excimer laser lithography is the most important direction in realizing technological methods for producing ultralarge integrated circuits at the level 16-64 Mbit. The principal advantage of electron beam lithography over optical lithography is a higher resolution level and the possibility of formation of a protective image, but among the factors limiting resolution are the reflection of electrons from the plate and their dispersal in the resist film. However, the principal shortcoming is the low productivity of the method. X-ray lithography, on the other hand, is the most promising process in the mass production of ultralarge integrated circuits at the level 64-256 Mbit, although many problems remain unsolved. Table 4 gives the characteristics of Soviet-produced electron beam and X-ray photoresists. [All 12 articles in this issue are devoted to research on the properties, development and use of photoresists, as well as photopolymerizing compositions, in the phototechnology of production of elements and circuits for electronic and optical devices.] Figures 4; references: 70 Western.

Principal Criteria for Choice of Photoresists for Submicron Photolithography

927K0053B Moscow *ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII* in Russian Vol 36 No 3, May-Jun 91 (manuscript received 16 Jul 90) pp 189-197

[Article by V. M. Treushnikov and A. V. Oleynik, Gorkiy State University]

UDC 773.92

[Abstract] The main subject of research was the factors determining resolution in the photochemical process of formation of a protective pattern for photoresists. The resolution of such a process is dependent on many factors but concentration is on those directly related to photoresist properties. The ideal characteristics of photoresists capable

of ensuring a limiting resolution in optical photolithography are defined. The principal research method is mathematical simulation, one of the aspects of automatic work planning as applicable to photochemical processes of formation of such a protective pattern. Emphasis is first on those models which can serve as a basis for computing the development profile. Three principal problems are solved in simulating the photochemical process of formation of a protective pattern: 1) computation of the distribution of illumination of the photoresist layer when using a given exposure method; 2) computation of distribution of products of a photochemical reaction in the photoresist layer after its exposure, 3) computation of the development profile proper, that is, the configuration and dimensions of those sectors of the photoresist layer after development on the backing surface. Figures 7; references 16: 10 Russian, 6 Western.

Photoresists for Optical Technology

927K0053C Moscow *ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII* in Russian Vol 36 No 3, May-Jun 91 (manuscript received 14 Nov 90) pp 238-245

[Article by V. A. Barachevskiy, Chemical Physics Institute, USSR Academy of Sciences, Moscow]

UDC 773.93:[771.531:621.3.049.75]

[Abstract] The use of organic positive and negative photoresists in optical phototechnology is reviewed. Since the highest requirements are imposed on light-sensitive media for producing holographic optical elements (HOE), particular attention is given to this aspect of the problem. The wide range of requirements imposed on HOE makes it necessary to have a wide variety of registry media for the phototechnology of their fabrication. Phase light-sensitive layers are required which include photoresists which do not absorb or scatter light radiation at the wavelength of the used laser radiation. A number of other current problems also are examined. This concise review of the results of research on the properties and possibilities of use of organic photoresists for fabricating the optical elements of optical devices of different types indicates good prospects for their introduction in optical phototechnology. In the coming years the need for new light-sensitive materials for this purpose will increase and it is therefore important to achieve further improvement of known and development of new organic and inorganic media for timely advances in optical phototechnology processes on their basis. Figures 8; references 20: 9 Russian, 11 Western.

State of the Art and Problems in Use of Resists in Microelectronics

927K0053D Moscow *ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII* in Russian No 3, May-Jun 91 (manuscript received 20 Jul 90) pp 253-267

[Article by G. K. Selivanov, V. V. Khozhanov and B. G. Gribov, Scientific Research Institute of Materials Science]

UDC 621.3.049.77.022:776;771.531

[Abstract] This is a review of the scientific and technical literature on the lithographic processing of semiconductor plates for the fabrication of superlarge microcircuits with a high degree of integration. Figure 1 is a block diagram of problems in microlithography; Fig. 2 is a diagram of modern trends in the development of microlithography. Table 1 lists the technical specifications for materials and the microlithography process in the production of superlarge circuits. Requirements on the microlithography process are formulated and the prospects for the development of lithographic equipment and materials are evaluated. Other figures and tables give pertinent information on multilayer technology and materials for submicron microlithography. Particular attention is given to the purity of materials and media for microlithography. Considerable advances in development of high-aperture projection optics and further development of photoresist technology and microimage formation techniques have made it possible for photolithography to overcome the 1 μm barrier and approach a size 0.4-0.5 μm . The X-ray, electron beam and ion lithography methods may be competitive with optical lithography when obtaining sizes of elements less than 0.5 μm . Materials for microlithography have recently been vigorously developed and a wide range of new photo-, electron beam and X-ray resists with the necessary lithographic properties with respect to resolution, resistance to heat and plasma and sensitivity are now available. Figures 6; references 73: 1 Russian, 72 Western.

On Phenomenon of Change in Photographic Material Speed in Electric Field

927K0099A Moscow *ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII* in Russian Vol 36 No 4, Jul-Aug 91 pp 277-281

[Article by A.Ya. Didenko, N.A. Dobrodeyev, R.V. Konoplich, V.I. Savkin, Moscow Engineering Physics Institute]

UDC 77.01:53

[Abstract] Studies show that the speed of grainy photographic materials (e.g., RF-3 types 25 and 29) depends on the electric field in a complicated fashion: it decreases with

an increase in the field strength and depending on the electric and light pulse timing, may decrease by more than two orders of magnitude. One possible mechanism of the decrease in photographic material speed—due to the possibility than photoelectrons may escape from the body and reach the surface of the emulsion microcrystal (MK) under the effect of the external electric field—is investigated. The results of theoretical analyses correlate quite well with the experimental data obtained earlier; the outcome of experiments to examine the effect of the electric field on the photolysis of photographic materials is described. The dependence of the direct blackening density on the number of light pulses with and without the electric field is examined and plotted. Experimental data are consistent with the proposed mechanism of negative photographic field effect. Figures 2; references 8.

Information Recording on KCl-In Crystals

927K0099B Moscow *ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII* in Russian Vol 36 No 4, Jul-Aug 91 pp 326-327

[Article by G.B. Gorin, K.Ye. Gyunsburg, N.P. Zvezdova, V.I. Kochubey, Scientific Research Institute of Mechanics and Physics at the Saratov State University]

UDC 535.37

[Abstract] The possibility of recording information on a KCl-In crystal for subsequent storage and reading in a light beam within a broad temperature range is investigated. The study demonstrates the luminescence centers, which are associations of indium atoms and intrinsic lattice defects, develop in a KCl-In crystal grown by Stockbarger's method; the centers are characterized by a high optical and thermal stability. The proposed recording method is based on creating such centers in the KCl-In crystal lattice by means of ionizing radiation, e.g., X-rays, ultraviolet radiation at $\lambda < 210$ nm, or an electron beam, in the light at any temperature within a 0-350°C range. Both analog and digital data can be thus recorded. Experiments show that data can be stored for three years and that multiple data readings do not result in losing any information; the recorded information can be erased by heating the crystal for 5 min at a 450°C temperature. In order to maintain the original brightness after 20 write/read cycles, the irradiation dose must be increased by 1.5-2 times. Figures 1; references 2.

LSI Circuit CAD Workstations: State and Outlook

927K0095A Kiev IZVESTIYA VYSSHIKH
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA
in Russian Vol 34 No 6, Jun 91 pp 5-11

[Article by A.I. Petrenko]

UDC 621.372.001.63

[Abstract] The importance of computer-aided design (SAPR) of user specified or application specified large scale integration circuits (BIS) for the national economy is stressed; today's digital and analog LSI circuits are classified into commercial and customized; the latter are further divided into fully customized and semicustomized. The types of master array chips (BMK) used for both types of custom-made LSI circuits are discussed. The specific problems arising in computer-aided design of custom LSI circuits are reviewed and their solutions are considered. A flow chart of the computer-aided design process, from the issuance of specifications to the preparation of control data for the image generator, is presented. Various chip-making methods are considered. SEG/CAD designs developed by Digital Equipment Corporation and the Solo 1400 V3 CAD workstation for LSI circuits developed by European Silicon Structure, Ltd., are described for illustration. The PRAM PC system specifically developed for use with microcomputers is regarded to be the most convenient and promising. Figures 7; tables 5; references 10: 3 Russian; 7 Western.

CAD Process Organization of Functional LSI Circuit Element Topology

927K0095B Kiev IZVESTIYA VYSSHIKH
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA
in Russian Vol 34 No 6, Jun 91 pp 12-16

[Article by S.N. Kupchinov]

UDC 621.3.049.77

[Abstract] The development of technologically invariant computer-aided design systems (SAPR) for large scale integration circuits (BIS) and the need to develop computer-aided design algorithms and subsystems capable of taking into account the changes in the design and technology constraints resulting from a transition from one LSI circuit design realization to another are recognized and the difficulty of designing the circuit topology which involves determining the mutual position of elements and their connection is discussed. An LSI circuit component makeup is developed and functional element topology design subsystem organization for LSI circuits components is proposed. The topology design system is aimed at use with a technologically invariant (TI) computer-aided design system. Topological structural models are developed for jointly solving the problem of element arrangement and junction layout in LSI logic cells. A procedure is developed for adapting the topology subsystem to the specific LSI circuit design versions and

algorithms and an application software package are formulated for designing the logic cell topology, making it possible to automate the development of a library of standard topology elements. The procedure and software are tested in developing topology fragments of an I²L microprocessor and a D-flip-flop. The results confirm the efficacy of the proposed methods, models, and algorithms. Figures 1; references 2.

Optimal Functional Element Configuration Models and Stochastic Algorithms of VLSI Circuits

927K0095C Kiev IZVESTIYA VYSSHIKH
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA
in Russian Vol 34 No 6, Jun 91 pp 45-49

[Article by Ya.Ye. Lvovich, A.A. Ryndin, O.I. Chernykh]

UDC 621.3.049.77

[Abstract] The lagging of computer-aided procedures of positioning the functional elements of very large scale integration circuits (SBIS) behind the current level of VLSI technology is identified and existing systems of interactive topology design are analyzed. It is shown that among the variety of placement algorithms, preference is given to the sequential placement algorithms based on connectivity and dichotomy division algorithms, as well as to iterative algorithms of pairwise permutations. The shortcomings of these procedures are discussed and the need to develop a sufficiently flexible algorithm which is capable of "self-adapting" according to *a priori* and current data, e.g., by stochastization, is recognized. Such adaptation may also be realized by developing stochastic algorithms for optimizing the placement of functional elements of VLSI circuits. The procedure for formulating stochastic adaptive algorithms for solving the optimization problem with Boolean variables is described in detail. The proposed algorithms have a sufficient number of free parameters which can be manipulated, thus creating the conditions for organizing flexible optimum point search adaptable to both *a priori* and *a posteriori* data. The stochastic algorithm is invariant to the placement criterion, making it possible to alter the criterion functional depending on the design features of the current topology synthesis stage and specific features of VLSI circuits. References 6: 5 Russian; 1 Western.

Minimizing Nonlinear Distortions in Pulse System

927K0095D Kiev IZVESTIYA VYSSHIKH
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA
in Russian Vol 34 No 6, Jun 91 pp 49-53

[Article by O.V. Stukach, V.N. Ilyushenko]

UDC 621.391.832.44

[Abstract] Existing methods of estimating the nonlinear distortions (NI) in a pulse system which often affect its dynamic range are considered and the shortcomings of these methods are discussed. The urgency of developing new criteria of estimating nonlinear distortions which

would simplify the problem of optimizing the structure and parameters of a nonlinear pulse system is recognized. It is shown that the dynamic range of highly nonlinear systems may be estimated more efficiently by the criteria of response shape invariance to the input signal amplitude; consequently, an attempt is made to determine the conditions of the nonlinear system response spike invariance to the input signal amplitudes. To this end, relations for calculating the invariance error are derived and methods of decreasing it are considered. It is shown that input signal amplitudes exist at which absolute invariance is attained. An algorithm for searching for such amplitudes and optimizing the parameters of a nonlinear system by the minimum invariance error criterion is proposed. For illustration, an n -type low-pass filter with one nonlinear capacitance is considered. Figures 3; references 5.

Numerical Analysis of Arsenic Diffusion Model at High Doping Levels

927K0095E Kiev IZVESTIYA VYSSHIKH
UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA
in Russian Vol 34 No 6, Jun 91 pp 74-79

[Article by V.I. Beregovoy, N.V. Grudanov]

UDC 621.382.82.001

[Abstract] The importance of diffusion processes in LSI circuit (BIS) technology, particularly in forming the structure and insuring its electric parameters, and certain spurious side-effects which offset the advantages of diffusion in CMIS (KMDP) are outlined; the urgency of using mathematical modeling for solving the problem of reducing the negative effect of diffusion by forming the necessary dopant profile is recognized. To this end, arsenic diffusion at high dopant concentrations is simulated by solving the equation of cluster generation and analyzing the resulting data. The mathematical model makes it possible to investigate the generation and recombination of arsenic clusters without making the assumption of steady-state process. The initial problem conditions are formulated and the cluster-generation model is numerically analyzed. The LSI circuit fabrication procedure route is used to illustrate the model. Calculations are performed on a BESM-6 computer by using a 10^{15} impurity concentration as a standard. Figures 3; tables 1; references 6: 3 Russian; 3 Western.

Adaptive Data Banks as Electronic Equipment CAD Subsystem Environment

927K0095F Kiev IZVESTIYA VYSSHIKH
UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA
in Russian Vol 34 No 6, Jun 91 pp 80-82

[Article by V.P. Koval]

UDC 658.512.22.011.56

[Abstract] The hierarchical design method which is a principal means of solving the problem of designing complex radio electronic equipment (REA) in fifth-generation computer-aided design (SAPR) and its underlying principles are considered; the need to ensure close information-level integration of CAD subsystems through a common representation of the application domain and the objects of design and to develop information interfaces is recognized; it is shown that in such a situation the data bank ceases to be a several system but becomes a part of the CAD system environment. Consequently, software for an information environment based on a data bank with adaptive organization is developed on the basis of a general-purpose data base management system (SUBD) by complementing it with a dedicated component or, in essence, developing a dedicated DBMS capable of maintaining long-term archives which are employed as CAD "experience". The DBMS is aimed at operating with on-line design data and is a decisive link in the CAD application module (PIIS) adaptability. References 3.

Electric Models of Optons for Computer Design of Optoelectronic Chips

927K0095G Kiev IZVESTIYA VYSSHIKH
UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA
in Russian Vol 34 No 6, Jun 91 pp 95-98

[Article by O.M. Mikhaylova, A.S. Sidorov]

UDC 621.382.82

[Abstract] Photon-coupled pairs (optons)—base components of today's optoelectronic microcircuits—consisting of an emitter and a detector with an optical interaction channel serving as an optical medium encased in a single rigid structure are considered. The use of computer-aided design systems (SAPR) for designing and analyzing complicated optoelectronic microcircuits is discussed. An electric model of a diode optocoupler which serves as the base element in a library of optoelectronic models developed for computer-aided design of optoelectronic chips is investigated; in the optocoupler model, the light emitting diode is simulated by an instantaneous two-terminal network with a voltage-current characteristic of an emitting p - n -junction while the nonilluminated photodiode is simulated by an instantaneous nonlinear one-port. The models of diode- and resistor-type optocouplers are formulated as subroutines and incorporated in the integrated circuit element analysis library. Specific computer analyses of static and transient conditions in digital and analog optoelectronic chips of various scale of integration have been performed with the help of the above models. Figures 1; references 3.

Weak Quasistationary Electromagnetic Field Identification Principles

927K0097A Kiev *TEKHNICHESKAYA ELEKTRODINAMIKA* in Russian No 5, Sep-Oct 91 pp 3-7

[Article by V.Ya. Lavrov, A.P. Pukhanov, Leningrad Aviation Instrument Engineering Institute]

UDC 537.811:681.5.015

[Abstract] The methods of identifying external quasistationary magnetic fields by solving Laplace's equation in a spherical system of coordinates for the scalar potential and its shortcomings for identifying the fields created by the avionics equipment are discussed; it is shown that in order to ensure the highest signal/noise ratio on the instrument output, the field strength should be measured at the points in space located close to the sources. Consequently, a problem of finding methods of identifying weak quasistationary electromagnetic fields is formulated; one of such methods is based on an equivalent substitution of the real field source with its multipole model. The mathematical model of the external magnetic field in the spherical system of coordinates coincides with the field description of multipoles located at the origin of coordinates. The uniqueness theorem makes it possible to interpret the expressions as a multipole field model outside the source bounded by a regular surface. The constants of integration are then found on the basis of expanding experimental data on the regular surface in terms of spherical functions. It is noted that the method may be extended to the electric field. Analytical calculations are found to be consistent with experimental measurements. The mean relative identification error is 4.3 percent. Figures 3; references 11.

Gaseous Discharge Plasma Propagation Velocity in Electric Field

927K0097B Kiev *TEKHNICHESKAYA ELEKTRODINAMIKA* in Russian No 5, Sep-Oct 91 pp 12-17

[Article by Yu.K. Bobrov, Istra Branch of All-Union Electrical Engineering Institute]

UDC 537.523

[Abstract] The electric strength of gaseous insulation is directly related to the conditions of discharge development and propagation at the leader stage, yet there are no self-consistent dynamic models of the leader channel plasma while the possibility of the plasma boundary movement in a gaseous medium due to heat conduction by electrons and thermal electron ionization has not been investigated. Consequently, a planar plasma boundary is considered and formulas are derived for its propagation velocity in a dense gas in order to establish the principal phenomena of the process. In so doing, the plasma boundary is approximated by the front of a nonequilibrium electronic thermal wave on the basis of the electric hydrodynamics equations. The

transition region structure is investigated. The dependence of the plasma front propagation velocity in the air on its electron temperature, i.e., the longitudinal electric field, is examined and plotted. The analytical data are consistent with the experimental results. Figures 2; references 4: 3 Russian; 1 Western.

Unipolar Shock Generator Energy Conversion in Circuit With Inductive Storage and Plasma Load

927K0097C Kiev *TEKHNICHESKAYA ELEKTRODINAMIKA* in Russian No 5, Sep-Oct 91 pp 25-30

[Article by K.V. Dubovenko, IIPIT at the Ukrainian Academy of Sciences, Nikolayev]

UDC 621.316:621.373

[Abstract] Successful development of compact unipolar shock generators (UUG) with a stored energy of up to 10 MJ and a stored energy density of close to 10 MJ/m³ as well as breakers for currents of up to 1 MA and a switching time of close to 10⁻⁵ prompted a numerical analysis of the dynamics of unipolar shock generator discharge into a nonlinear plasma load, i.e., the electric discharge channel, in a circuit with an inductive energy storage (INE). To this end, the processes occurring in a unit containing a disc-type unipolar shock generator and a two-stage breaker (with a mechanical first stage and explosion-type second stage) are simulated. The electric and energy characteristics of the discharge are determined and their dependence on the medium temperature and pressure in the electrode gap is established. It is shown that up to 40-50 percent of the energy released by the generator in the circuit may be injected into plasma during the discharge. Figures 5; references 12: 8 Russian; 4 Western.

Noise Immune High-Voltage Converter for Forced Charge Integrator

927K0097D Kiev *TEKHNICHESKAYA ELEKTRODINAMIKA* in Russian No 5, Sep-Oct 91 pp 108-112

[Article by G.F. Belousov, R.Sh. Vakhitov, V.P. Kuznetsov, V.L. Gorbunov, Electrophysics Institute at the Urals Branch of the USSR Academy of Sciences, Ufa]

UDC 621.314

[Abstract] The problems arising in the development and operation of high-voltage converters for charging capacitive charge integrators operating within industrial units—forcing the charging process in order to attain the necessary productivity and ensuring noise immunity—are addressed. Powerful short electromagnetic pulses (EMI) affecting the power supply circuit, conversion elements, and control system and capable of destroying integrated circuits are examined. The issue of developing the control system, inverter unit, and transformer-rectifier assembly of the capacitive charge integrator is considered from the viewpoint of solving the above

problems. A block diagram of the proposed converter is shown and its operating principle is described. Oscillograms of the voltage on the filtering capacitor and switching capacitor are plotted and the dependence of the integrator charging time on the number of modules

in the transformer-rectifier assembly is investigated. The modular transformer-rectifier assembly design makes it possible to employ RF diodes and attain a 4 kHz inverter frequency thus decreasing the overall dimensions and mass of electromagnetic units. Figures 4; references 4.

New Communications Bank has Opened Its Doors

927K0096A Moscow VESTNIK SVYAZI in Russian
No 8, Aug 91 pp 2-3

[Article by M.A. Tsarkova, Svyaz-Bank]

[Abstract] The need for a unified technical and economic policy and a single financial institution for implementing large-scale communications construction projects, retooling existing communications gear, and developing, designing, and implementing new equipment is identified. Due to limited state appropriations, an Industry Fund was set up in 1989 and raised 76.3 million rubles in credits; on 20 May 1991, its directors formed an inter-branch commercial bank which was registered under the name of "Svyaz-Bank" at the USSR State Bank, Reg. No. 1470. The new bank's directors are the USSR Telecommunications Ministry and communications ministries of a number of republics, operating enterprises, corporations, and communication enterprise associations. The bank will lend money at a 6 percent interest. The bank's plans for the near future are outlined.

Rural Radiotelephone Communication is Needed

927K0096B Moscow VESTNIK SVYAZI in Russian
No 8, Aug 91 pp 3-4

[Article by D.N. Zharov, USSR Telecommunications Ministry]

[Abstract] The low proportion of rural population with telephones (7 per 100) despite the fact that more than 80 percent of new telephones are installed in the country is identified and the need to bridge this gap is identified. It is shown that the problem, exacerbated by the fact that cable shortages make it difficult to install telephone more than 4-5 km away from the ATX, may be partially solved with the help of radio facilities. Since radio telephone equipment is not being commercially produced in the USSR, some equipment is purchased abroad and negotiations are underway with foreign companies for supplying more equipment. Efforts to develop domestic mobile communication systems are described and the cost of developing and producing specific types of communication gear is summarized. It is expected that the program would require 450 million rubles. It is emphasized that even when implemented, the radio telephone system will not solve the problem of providing telephone service to extremely remote and sparsely populated areas. Tables 1.

Communication Enterprises and Market

927K0096C Moscow VESTNIK SVYAZI in Russian
No 8, Aug 91 pp 22-24

[Article by Yu.I. Mkhitarian, candidate of economic sciences, Vestnik svyazi stringer]

[Abstract] A new approach to communication enterprise management during the transition to a market economy is considered from the viewpoint of the increasing importance of information science and information transmission technologies in the modern world. The role of communication and information in an advanced society is examined and the privatization and diversification experience in the communication and information industries in the United States, Great Britain, and Japan is summarized. The specific problems facing the USSR in developing new forms of ownership are discussed and three principal components of economic control mechanisms relevant to the communication and information industries are investigated; emphasis is placed on developing a tax policy which would stimulate research and development and investment in the communication industry. The role of credit availability in the market economy is examined. To be continued.

Damaged Plastic Cable Reconditioning

927K0096D Moscow VESTNIK SVYAZI in Russian
No 8, Aug 91 pp 41-42

[Article by Yu.I. Parfenov, Yu.V. Dobin, L.I. Kayzer, V.B. Shalygin, V.V. Pchelintsev (deceased), B.B. Shurukhin, A.S. Tsypanov, Leningrad Branch of the Scientific Research Institute of Communications and All-Union Scientific Research Institute of Synthetic Rubber]

[Abstract] A new method of reconditioning moisture-damaged cables with a polyethylene conductor insulation and polyethylene sheathing which prevents them from getting wet again is described; the method is developed jointly by the staff of the Leningrad Branch of the Scientific Research Institute of Communications (LONIS) and All-Union Scientific Research Institute of Synthetic Rubber (VNIISK). The mechanism of water penetration into the cable due to its loss of seal and the resulting spreading of moisture through the cable which damages individual conductors are considered. The shortcomings of the existing moisture-removal method by purging are discussed and a new method of removing moisture from the cables by filling the voids with a polymerizing composition and filling cable cores with a water repellent is described. The water repellent filler consists of two components—oil extended rubber and a hardener. The filler's physical and chemical properties are outlined and filler outlays for various types of cable are summarized; depending on the brand, they vary from 10 to 120 kg/km. The filling and joint sleeve filling procedure is described. Tables 1.

High Definition Television

927K0096E Moscow VESTNIK SVYAZI in Russian
No 8, Aug 91 pp 43-45

[Article by V.Ye. Tesler]

[Abstract] Continued from Vestnik svyazi No. 7, Jul 91 where the a method of forming the TV signal for high

definition TV, the reflection modulation, suggested by V.Ye. Tesler and I.A. Averbukh is explained. The three basic principles of high definition television systems (TVVCh)—the "reflection" quadrature modulation which makes it possible to compress the frequency band by twofold; a 20 percent reduction in the number of lines in the HDTV standard making it possible to reduce TV signal frequency band by 20 percent; and the use of variable horizontal definition making it possible to reduce the frequency band by another 20 percent, thus ensuring a total HDTV luminance signal reduction factor of 0.32—are considered. The composite color signal of the broadcasting signal is formed by time division multiplexing of reflection quadrature modulated chrominance and luminance signals. The principles underlying the luminance and chrominance signal modulation are outlined. It is shown that in its shape and content, the chrominance signal is similar to the NTSC chrominance signal translated to a low-frequency carrier. Two versions of chrominance signal decoding on the receiving end are described and specifications of the HDTV broadcasting system for a 1,250/50/2:1 studio standard (or 1,250/50/1:1) are summarized. The reflection modulation system meets the principal requirements of HDTV broadcast systems—ensuring high image quality and professional compatibility, i.e., the possibility of using existing program distribution systems for their transmission. Tables 3.

Measuring Optical Cable Parameters During Fiber Optic Transmission Line Construction

927K0096F Moscow VESTNIK SVYAZI in Russian
No 8, Aug 91 pp 48-50

[Article by I.S. Goldfarb, V.N. Spiridonov, Central Communications Scientific Research Institute]

[Abstract] The need to measure the parameters of optical cable (OK) lines, both already laid and under construction, in order to ensure their performance and reliability at the requisite levels is recognized and the experience accumulated in this field at home and abroad is summarized; the most significant optical cable parameters and methods of monitoring and controlling them during various stages of fiber optic transmission line (VOSP) construction are identified. The relative advantages and shortcomings of the proximate analysis, open circuit, and backscattering methods are discussed and the latter is regarded as the most promising; a block diagram of measurements by the backscattering method and an example of backscattering signal recording obtained by a reflectometer are cited. Data on the proposed optical cable parameter measurements correspond to established practices in the USSR and abroad for fiber optic transmission line construction while the measurement procedure is largely the same as the one used abroad. The need to continue research in communication lines with an 80-100 km regeneration leg using cables with a lower attenuation is identified. Figures 2; references 2.

Industry's Financial Condition

927K0096G Moscow VESTNIK SVYAZI in Russian
No 8, Aug 91 pp 55-57

[Article by V.A. Voronkov, Moscow Communications Institute]

[Abstract] Continued from *Vestnik svyazi* No. 7, Jul 91. The status of the communication industry's sources of funds as stipulated by the individual enterprises' statutory funds is investigated. In particular, the balance of the statutory fund and working capital is analyzed; to this end, figures for 1975, 1980, 1985, and 1988 are compared. A positive trend in the balance of working capital is noted. The state of working capital formation sources is analyzed and the ratios of debit and credit to the working capital in the industry for the same years are summarized. The industry's solvency and credit risk are examined and the asset/liability ratios are analyzed for the same years. In the years under study, assets exceeded liabilities by 7 to 12 percent. To be continued. Tables 6.

Principal Development Trends of Communication Enterprise Power Supply Systems and Equipment

927K0100A Moscow ELEKTROSVYAZ in Russian
No 7, Jul 91 pp 2-3

[Article by I.V. Myagkov, M.V. Brodskiy (deceased)]

UDC 621.311.6

[Abstract] The principal development trends of power supply systems and equipment of communication enterprises are considered and the problems facing communication equipment designers and operators are addressed. In particular, the issue of power supply voltage surges which affect today's microelectronics and digital devices and of ensuring stable communications equipment operation with secondary power supply (VIP) developed on the basis of voltage converters built directly into this equipment is discussed. The problem of preventing voltage fluctuations and spontaneous generation in powerful rectifiers with a large time constant is considered and the lag in the development of positive voltage booster converters which help to solve this problem is recognized. The development of low-frequency converters (below 12-15 kHz) and uninterrupted power supply systems for quasioelectronic automatic telephone exchanges and subscriber digital concentrator (ATsK) is reported. New decentralized power supply systems prompted by advances in storage cell designs which make it possible to position power supply sources in direct proximity to the communication equipment are described. References 6.

Power Supply Systems of Large Communication Enterprises

927K0100B Moscow ELEKTROSVYAZ in Russian
No 7, Jul 91 pp 4-5

[Article by M.V. Brodskiy (deceased), Ye.V. Martynov]

UDC 621.311.6:621.391

[Abstract] The changing approach to output voltage stability of electric power supply systems necessitated by the emergence of new electronic equipment which is sensitive to the dynamic and static stability components and voltage surges with sharp leading edges is discussed. Domestic power supply devices (EPU) for various voltage ratings which meet the requirements of electronic and quasioletronic automatic telephone exchanges are considered; attention is focused on buffer power supply systems both without any devices blanking the excess storage cell voltage and with positive voltage booster converters. A power supply system with positive voltage booster converters and combined rectifiers and storage batteries (AB) separated from the load and its design are described. The system is capable of operating both off- and on-line. A new double voltage power supply system without storage cells which uses only combined rectifiers with a 60 V and 24 V rating and has a very large static and dynamic stability margin is described. The above power supply systems are being commercially produced. Figures 6; references 4.

Uninterrupted Power Supply System for Remote Concentrators and Low- and Medium-Capacity Electronic ATX

927K0100C Moscow ELEKTROSVYAZ in Russian
No 7, Jul 91 pp 6-7

[Article by V.Ye. Rubinraut, R.B. Golubovich]

UDC 621.311.6.024

[Abstract] An uninterrupted power supply system (UGPK) intended for delivering 60 V DC to the remote concentrator equipment as well as low- and medium-capacity electronic ATX ATSE-200 and MT-20, integrated quasioletronic ATX IATSKE-1, quasioletronic ATX Kvant, or similar devices are described. The power supply system is designed for operating from three-phase 380 V, 50 Hz mains with a neutral wire, either without or with a storage battery consisting of 27-28 acid or 40 alkaline cells and separated from the load. A block diagram of the uninterrupted power supply system and its principal specifications as well as the characteristics of uninterrupted power supply system rectifiers are presented. The positive voltage booster converter stabilizes the output voltage and suppresses the voltage ripples on the unregulated rectifier (NUV) output. A modification of the uninterrupted power supply system—the UGPP—consisting of three combined rectifiers and capable of recharging the storage battery is described. The UGPK and UGPP power supply systems have been commercially produced since 1991 at the Promsvyaz plant in Mordva. Figures 1; tables 2.

Transmission Technology on Eve of New Century
927K0100D Moscow ELEKTROSVYAZ in Russian
No 7, Jul 91 pp 16-18

[Article by H. Bauer, Siemens AG]

[Abstract] Recent achievements in the fields of microelectronics and digital transmission systems (SP) are examined from the viewpoint of the state of the global transmission system market against the backdrop of increasingly high transmission rates and flexible and economical communication networks. Principal attention is focused on the redistribution of the world transmission system market and the emergence of new transmission system technologies, e.g., fiber optic cables, digital microwave links, satellite communication systems, and cellular and mobile telephone systems. Computer-aided network control systems and their development outlook are considered. The role of the Siemens AG company in the development of new transmission systems is emphasized. The need to develop a unified information transmission technology for all network layers, set up coordinated network operation and control, and develop network component modules suitable for upgrades is identified. The article originally appeared in *Siemens Review* Vol. 56 No. 2, 1989, pp. 4-7. Figures 3; References 1.

Fiber Optic Transmission System Implementation in Consolidated Automated Communication Network: Problems and Outlook

927K0100E Moscow ELEKTROSVYAZ in Russian
No 7, Jul 91 pp 21-23

[Article by A.G. Yermolov, Ye.A. Zarkevich, O.N. Makeyev, Yu.V. Surin, S.A. Ustinov]

UDC 621.373.826:621.39

[Abstract] The development of fiber optic transmission systems (VOSP) in other countries since the 1980's and their transmission rates, wavelengths, and cable types are outlined and fiber optic transmission system development in the USSR is summarized; domestic fiber optic transmission systems designed for use in local, area-wide, and trunk networks of the Consolidated Automated Communication Network (YeASS) are described. These fiber optic transmission systems represent equipment complexes of optical line circuits (OLKT), optical cables (OK), instrumentation, and wiring and assembly kits. The systems are interfaced with digital channeling and trunking equipment. The specifications and characteristics of fiber optic transmission systems are summarized and power supply systems for unmanned regeneration repeaters are described. The Sopka equipment operating on a 1.3 μm wavelength with graded-index fibers and intended for setting up transmission line circuits is described. Fiber optic transmission system implementation problems and development outlook are discussed. Shortages of modern

switching equipment in the USSR which impede the development of fiber optic transmission systems are identified. Tables 2; references 5

New Types of Sleeves for Fiber Optic Cable Wiring

*927K0100F Moscow ELEKTROSVYAZ in Russian
No 7, Jul 91 pp 25-26*

[Article by V.B. Katok, G.P. Levchenko]

UDC 681.7.068

[Abstract] The design of coupling and joint sleeves used on fiber optic cable (VOK) during the laying of fiber optic communication lines (VOLS) for area-wide and urban networks is described; the sleeves made from a synthetic material make it possible to join and split fiber optic cables and protect cable joints and couplings from exposure to external factors. The role of these sleeves during the early stages of fiber optic communication line implementation is recognized. The proposed design has a number of advantages over the SMOK and MMOK joint sleeves used today in that it can be rewired many times during its operation and does not call for using open flame for its installation and sealing. The design is promising for commercial production which is expected to commence in 1991 in Kiev. Figures 2; references 4.

Improving Satellite Repeater Resource Allocation Methods

*927K0100G Moscow ELEKTROSVYAZ in Russian
No 7, Jul 91 pp 31-33*

[Article by I.F. Mikhalevich]

UDC 621.396.946.2

[Abstract] Characteristic features of today's and tomorrow's satellite communication systems (SSS) are considered and the need to service them under nonuniform and intermittently changing traffic is identified. The resulting problem of expanding the number of satellite communication system users and increasing its profitability by improving resource allocation methods (SRR) of expensive satellite communication system repeaters

(TR) is considered. An analysis shows that it is possible, in principle, to design public and private repeater channel use systems on the basis of unified engineering premises. A controlled resource allocation method is proposed; it makes it possible to adjust the existing repeater resource allocation pattern in each specific situation and control earth station (ZS) access to the repeater during the satellite communication system operation and increase or decrease the satellite communication system volume as well as reassign the earth station ranking. A flow chart of the controlled repeater resource allocation algorithm is presented. Figures 3; tables 1; references 4.

Earth Station Receiver Checking and Redundancy System

*927K0100H Moscow ELEKTROSVYAZ in Russian
No 7, Jul 91 pp 33-35*

[Article by K.N. Martyshevskiy, V.P. Mushkov, L.A. Don]

UDC 621.372.553:621.317.7.088

[Abstract] The stringent requirements imposed on redundant low-noise amplifiers (MShU) used at earth stations receiving signals simultaneously in several channels, both with respect to ensuring fast system operation when the working low-noise amplifier fails and preventing false operations or failures to operate, are discussed and the need constantly to monitor the status of the low-noise amplifiers and their backup system is identified. The advantages and shortcomings of existing standby systems are considered and a new design and operating principle of a receiver monitoring and redundancy system are presented. An experimental unit was assembled for testing the new design's feasibility; tests data show that the unit makes it possible to switch from the principal to the standby receiver efficiently upon losing power supply. The new design makes it possible constantly to check the characteristics of the standby equipment and prevents false operations of the main-to-standby switching system without interfering with the signals being received. In the proposed design, the same elements, e.g., pilot frequency generator, are used for both the continuous checking and redundancy functions. Figures 2; references 6.

Electromagnetic Characteristics of Electrically Inhomogeneous Half-Space as Conductor of Sinusoidal Current

927K0054A Kiev *TEKHNICHESKAYA ELEKTRODINAMIKA* in Russian No 4, Jul-Aug 91 (manuscript received 11 Oct 90) pp 3-7

[Article by V. N. Ostreyko, candidate of technical sciences, Northwestern Polytechnic Institute, Leningrad]

UDC 621.3.01

[Abstract] One of the model problems in the theory of a variable electromagnetic field relates to a conductor in the form of a half-space. Its solutions corresponding to the case of a homogeneous half-space with linear and nonlinear magnetization characteristics are widely used in evaluating the electromagnetic properties of conductors of finite dimensions. However, there has still been no adequate study of the distribution of a variable electromagnetic field in inhomogeneous conductors, although the technical applications of such conductors are constantly expanding. This dictated close examination of corresponding electromagnetic problems allowing analytic solutions. Accordingly, an analytic solution was obtained for the equations for an electromagnetic field in an inhomogeneous half-space whose conductivity decreases as a power function with an increase in distance from its surface. An analysis was made of the dependence of impedance and other electromagnetic characteristics of such an inhomogeneous half-space on the rate of decrease in its conductivity and these were compared with the corresponding characteristics of a homogeneous half-space. Conductors of the considered type can be produced, for example, by powder metallurgy methods. Figure 1; references: 7 Russian.

Electrodynamic Forces in Coaxial Cylindrical Resonator

927K0054B Kiev *TEKHNICHESKAYA ELEKTRODINAMIKA* in Russian No 4, Jul-Aug 91 (manuscript received 18 Jun 90) pp 19-21

[Article by A. V. Burov, candidate of physical and mathematical sciences, Naval Academy, Leningrad]

UDC 538.3.32

[Abstract] In an earlier study (DOKL. AN SSSR, Vol 270, pp 586-589, 1983) the author demonstrated theoretically the possibility of the existence of an unstable total ponderomotive force in an isolated geometrically unclosed conductor with a current. That finding is correct for conductors of any configuration. In this article the results from the earlier study are made more specific and the total ponderomotive force arising during the electrodynamic interaction of currents in a coaxial cylindrical resonator present in a segment of an open coaxial line is determined. After presenting a technical description of the cylindrical resonator and formulating the problem a general expression is derived for the mean total force of interaction of all currents in the

resonator. Numerical computations are given for a specific case. The principal vector of all the electrodynamic forces imparted to a coaxial cylindrical resonator with a current isolated from all external fields is determined by expression (8) derived in this article. Figure 1; references: 3 Russian.

Calculation of Electromagnetic Loads of Cryoturbogenerator With Low-Frequency Rotor Oscillations Using Equivalent Circuits

927K0054C Kiev *TEKHNICHESKAYA ELEKTRODINAMIKA* in Russian No 4, Jul-Aug 91 (manuscript received 25 Jun 90) pp 79-85

[Article by V. P. Kuyevda and S. N. Balyuta, candidates of technical sciences, KTIPP, Kiev]

UDC 621.313.322

[Abstract] A method is described for computing electromagnetic loads in the electric circuits of the rotor of a cryoturbogenerator with low-frequency oscillations of its rotor on the basis of linearized Park-Gorev equations, making use of equivalent substitution circuits. This article essentially represents continuation of recently published research by the authors in this same journal (*ELEKTRODINAMIKA*, No 2, pp 71-75, 1991). The analysis is limited to small rotor harmonic oscillations. Expressions are derived for complex values of stator currents and the currents in rotor circuits are determined, making it possible to ascertain the electromagnetic moment of rotation of a cryoturbogenerator rotor as a function of time, as well as the oscillation damping factor, the angular frequency of free rotor oscillations in a magnetic field and other pertinent performance parameters. The proposed computation program was used in preparing a program for a YeS computer and computations were made of the operating mode of one of the variants of a cryoturbogenerator, the KTG-300-2, with small perturbations. References: 6 Russian.

Protection Against Ferroresonance of Voltages in Electric Networks

927K0054D Kiev *TEKHNICHESKAYA ELEKTRODINAMIKA* in Russian No 4, Jul-Aug 91 (manuscript received 18 Dec 89) pp 92-98

[Article by Ch. M. Dzhuvarly, academician, Azerbaijan Academy of Sciences, Ye. V. Dmitriyev, doctor of technical sciences, Physics Institute, Azerbaijan Academy of Sciences, Baku, A. K. Shidlovskiy, academician, Ukrainian Academy of Sciences, V. G. Kuznetsov, corresponding member, Ukrainian Academy of Sciences, Electrodynamics Institute, Ukrainian Academy of Sciences, Kiev, K. M. Antipov, candidate of technical sciences and V. M. Maksimov, USSR Ministry of Power and Electrification, Moscow]

UDC 621.311

[Abstract] Ferroresonance overvoltages arise in electric networks when after commutation a circuit is formed with

series connection of a capacitive reactance and a nonlinear inductance. Five methods for contending with ferroresonance were investigated: prevention of formation of a ferroresonance circuit; detuning of ferroresonance circuit forming from a power source, capacitances and inductances of transformers; reduction in quality of the ferroresonance circuit by the cutting in of a resistor; cutting of a constant source of electric power into the resonance circuit; use of a protective disconnection. The latter three measures required the development of special ferroresonance transducers, logic circuits and a system for control of the cut-in elements and existing disconnection systems. A detailed analysis of application of these measures to a specific type of ferroresonance made it possible to recommend an optimal technical solution in each case. Most of the research was carried out using a mathematical model with computer calculation of the process of appearance of ferroresonance and its suppression with simulation of the operation of protective devices, devices for suppressing ferroresonance and systems for their control. The effectiveness of specific technical solutions was checked experimentally in electric networks. Figures 3; references: 3 Russian.

Reduction in Quantization Error of Digital Extreme Bridges With Nonreversing Digit-by-Digit Balancing Algorithms

927K0054E Kiev *TEKHNICHESKAYA ELEKTRODINAMIKA* in Russian No 4, Jul-Aug 91 (manuscript received 23 Nov 90)pp 108-112

[Article by A. I. Novik, doctor of technical sciences, Electrodynamics Institute, Ukrainian Academy of Sciences, Kiev, and N. D. Pustovalov, PANKh Scientific Production Association, Krasnodar]

UDC 621.317.733

[Abstract] In digital extreme bridges the bridge measuring circuit has the lowest sensitivity in the neighborhood of the balancing point. A new algorithm for unidirectional digit-by-digit balancing of a digital extreme bridge is proposed which makes it possible to increase the sensitivity of the bridge measuring circuit near the balancing point and to decrease the minimal admissible extent of the working zone of the bridge and thereby to reduce the quantization error. The structure of the algorithm, which is compared with traditional algorithms, is represented in Fig. 2. The step-by-step application of the algorithm is discussed. Use of the algorithm is illustrated for several variants of the problem. This article represents an elaboration of research published by A. I. Novik in the monograph "Sistemy avtomaticheskogo uravnovesivaniya tsifrovyykh ekstremalnykh mostov peremennogo toka" (Systems for Balancing Digital Extreme a-c Bridges), Frunze, AN KirgSSR, 1963, and subsequent articles devoted to this subject by A. I. Novik, et al. in *TEKHN. ELEKTRODINAMIKA*, No 6, pp 77-81, 1986 and No 5, pp 71-77, 1988. Figures 3; references: 7 Russian.

Methods of Developing Pulse Capacitors With Increased Specific Energy

927K0107A Moscow *ELEKTROTEKHNIKA* in Russian No 7, Jul 91 pp 2-4

[Article by L.T. Vekhoreva, G.S. Kuchinskiy, O.V. Shilin, I.V. Yermilov, B.B. Bilalov, V.I. Rud]

UDC 621.319.4.001.4

[Abstract] The main trends in the development of modern pulse capacitors are identified as increasing their specific energy, lowering their inductance, and increasing their reliability; principal attention is focused on the issue of increasing the specific energy capacity of today's pulse capacitors. Ways of achieving this objective are formulated on the basis of analyzing recent studies in this field; in particular, it is shown that the specific energy can be increased by using polymer capacitor films with an increased electric strength of 600-800 kV/mm and a reduced number of weak spots per unit of area as well as a low spread of strength values; using capacitor papers with an increased electric strength, a density of over 1.35 t/m³, and a reduced number of conducting inclusions; and other measures. The characteristics of several types of pulse capacitors are summarized; the dependence of the breakdown electric field strength of paper and paper-and-film dielectrics on the castor oil-impregnated insulator thickness and the dependence of the normal life (number of pulses) of paper and paper-and-film dielectrics on the castor oil-impregnated insulator thickness are examined and plotted. It is noted that as the specific stored energy rises, it is expedient to increase the capacitor reliability for a given guaranteed life and develop capacitor diagnostics methods and devices to ensure timely detection of faulty products during testing and operation. Figures 2; tables 1.

Time Response of Spark Gaps With Field Distortion

927K0107B Moscow *ELEKTROTEKHNIKA* in Russian No 7, Jul 91 pp 24-27

[Article by V.V. Ashmarin, S.A. Kalikhman, Chuvash State University imeni I.N. Ulyanov]

UDC 621.316.933.001.5

[Abstract] The operation of spark gaps with field distortion (RIP) as a part of capacitive energy storage devices (ENE) is largely determined by their time lag response, i.e., the dependence of the operation delay time on the working voltage amplitude, making it necessary to estimate very accurately this characteristic in the design phase of spark gaps with field distortion for synchronous operation of capacitive energy storage devices with a large number of spark gaps. Consequently, the possibility of calculating the time response of spark gaps with field distortion which meet the requirements imposed on their mathematical expectation and standard deviation necessary for ensuring their synchronous operation is investigated. The electric field in spark gaps with field distortion is simulated by the method

of continua and the threshold voltage is determined by the incomplete discharge method. Formulas are derived for approximating the threshold voltage accurately within 12 percent. The design of a four-channel spark gap with two control electrodes is described and time responses of spark gaps with one and two control electrode are examined and plotted. The proposed procedure for determining the time response of spark gaps with field distortion is demonstrated to be suitable for estimating the spark gaps time lag within a working voltage range between static and threshold values and may be used for designing spark gaps with specified characteristics; the use of the procedure for designing spark gaps with field distortion with two control electrodes makes it possible to develop devices with an increased response speed and a high operating reliability. Figures 5; references 14: 10 Russian; 4 Western.

Design of Electromagnetic Elements for Pulse Electric Systems

927K0107C Moscow *ELEKTROTEKHNIKA* in Russian No 7, Jul 91 pp 27-31

[Article by G.N. Senilov, Moscow Energy Institute]

UDC 621.374.001.24

[Abstract] The differences in the design of elements of pulse electric devices and electric motors or generators are considered and it is emphasized that the air gap in the former is a useful rather than negative factor since most of electric energy is concentrated there; consequently, the energy stored in the gap is the principal design and analysis criterion. The pulse electric system design and analysis procedure is formulated and reduced to three basic stages: solving normalized differential equations (NDU); optimizing all energy storage devices for their overall dimensions; and transforming the solution to a numerical form. For illustration, the design and analysis of pulse ignition transformers (ITZ) which are the most complicated element of aircraft strobe lights (SIO), direct current converters with a backward diode in the secondary circuit (POD), and magneto are considered. Figures 9; references 5.

Generation of Amplitude-Stabilized Powerful High-Voltage Pulses

927K0107D Moscow *ELEKTROTEKHNIKA* in Russian No 7, Jul 91 pp 31-34

[Article by V.I. Perevodchikov, D.A. Skibityanskiy, V.A. Khasanov, I.G. Khomskiy, All-Union Electrical Engineering Institute]

UDC 621.374.027.6.001.5

[Abstract] The need to form amplitude-regulated powerful high-voltage pulses controllable within a broad range of durations and period-to-duration ratios is identified and two types of regulating the pulse voltage—series and parallel—are considered. For series voltage stabilization, the electronic rectifier is connected in series with the load and performs two functions: those of the key and regulating elements. For parallel stabilization, two electronic rectifiers are necessary: a working rectifier in series with the load serving as a key element and a shunting rectifier parallel to the power source. The design of a beam switching tube in which amplitude-regulated powerful high-voltage pulses are used is presented and its operating principle is described. Oscillograms of the load current pulses and load voltage are plotted. Specifications of regulated beam switching tubes on the basis of ELV-4/40 rectifiers are summarized; the advantages of beam switching tubes with parallel voltage regulation over the series type are outlined and it is shown that the former can be efficiently used in devices with self-contained power supply systems; series-regulated beam switching tubes are preferable in other cases. Figures 4; tables 1; references 3.

Methods of Generating Mechanical Loads and Checking Insulation Condition During Accelerated Reliability Tests of Electric Machines

927K0107E Moscow *ELEKTROTEKHNIKA* in Russian No 7, Jul 91 pp 47-50

[Article by N.L. Kuznetsov, S.A. Makidonskiy]

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[Abstract] The goals pursued in reliability tests of electric generators and motors—to identify unreliable elements (the so-called "weak links") and quantifying the relationship between the level of principal external factors and the weak link's time to failure—are discussed and an attempt is made to develop methods of adequately developing mechanical loads in insulation and monitoring the coil end (LCh) vibration and the status of winding insulation during the tests. It is shown that mechanical loads developing in coil ends under the effect of electrodynamic forces are one of the principal causes of mechanical failures in induction motors. Three principal loading methods are investigated: creating an artificial imbalance on the tested machine shaft; starting and reversing the motor frequently; and creating flexural vibrations in winding models. Attention is focused on measuring the coil end vibration and measuring the natural vibration frequencies of coil ends. The dependence of the stator coil ends' first natural vibration frequency on temperature is examined. The design of a device for detecting shorted coils in the induction motor stator winding is described. The above testing and monitoring systems make it possible considerably to decrease the number of motors and generators necessary for testing. Figures 3; references 6.